Patent Claims

1. A device for contactless electrical power transmission and/or a control device in a system consisting of at least one stationary and one moving part between which power is to be transmitted, having at least one means in the moving part to be controlled and supplied with power, characterized in that a series-resonant circuit capacitor (C_G) of a frequency generator is connected to a primary winding (3a) of an inductive transformer that bridges an isolating point (3c) between the stationary part and the moving part, and in that a secondary winding (3b) of the transformer arranged on the moving part is connected to at least one actuator control element (4) in the form of a matrix arrangement (4a, 4b, 4c) of switchable power semiconductors (S1, ..., S4).

2. The device for electrical power transmission and/or a control device in a system in which power is to be transmitted, having at least one means in the moving part that is to be controlled and supplied with power, characterized by the following features:
- a frequency generator (2) consisting of an inverter with switchable semiconductor switches T1–T4 in a matrix arrangement and a downstream series-resonant circuit (L_G, C_G) whose resonance frequency (f_G) matches the inverter frequency (f_W),
- a control element (4) associated with the means that is to be controlled and supplied with power, containing a matrix arrangement (4a, 4b, 4c) of switchable power semiconductors (S1, ..., S4), said control element (4) impressing the current (i_G, i) that was tapped at a series-resonant circuit capacitor (C_G) of the frequency generator (2) – separated into positive and negative half-waves or segments of these half-waves – into the means (5, 5a) to be controlled and supplied with power.

3. The device according to Claim 1 or 2, characterized by the following features:
a) in order to form an output voltage (u'_A, u_A) of the control element (4) with only one polarity of the output conductors (A, B'), the actuator control element (4a, 4b) has unipolar switchable power semiconductors (S1, ..., S4) in a matrix arrangement,
b) the unipolar switchable power semiconductors are placed relative to the polarity of the output voltage, in which they take up the output voltage (u'_A, u_A) as blockage voltage and switch off the current ($-I_A$) from the positive output conductor to an alternating current input.

4. The device according to Claim 1 or 2, characterized in that, in order to form an output voltage (u'_A, u_A) of the control element (4) with alternating polarity of the output conductors (A, B'), the actuator control element (4c) has bipolar switchable power semiconductors in a matrix arrangement, said semiconductors selectively blocking positive or negative voltages and switching off currents in both conduction directions.

5. The device according to one of Claims 1 to 4, characterized by the following features:
- the actuator control element (4) comprises regulating means (4_R) and controlling means (4_{ST}) for impressing positive and negative half-waves or half-wave segments of the higher-frequency alternating current (i) into the actuator (5, 5a),
- the regulating means (4_R) is connected the controlling means (4_{ST}) in order to form different-sized half-wave segments of the current (i) through a signal (φ) as a function of the magnitude of the difference ($u_S - u'_A$) between the setpoint (u_S) and the actual value (u'_A) of the actuator voltage,
- the regulating means (4_R) is connected to the controlling means (4_{ST}) in order to control the power semiconductors (S1, S3, S2, S4) through the signal (G/W) as a function of the polarity sign of the difference ($u_S - u'_A$) between the setpoint (u_S) and the actual value (u'_A) of the actuator voltage, in such a way that, when the polarity sign of the difference ($u_S - u'_A$) is negative, a successive charge or power is withdrawn from the actuator (5, 5a) from one half-wave to the next and, when the polarity sign of the difference ($u_S - u'_A$) is positive, a successive charge or power is supplied to the actuator (5, 5a) from one half-wave to the next.

6. The device according to one of Claims 1 to 5, characterized in that the means to be controlled and supplied with power is configured as a capacitive actuator.

7. The device according to one of Claims 1 to 6, characterized by the following features:
a) the controlling means (4_{ST}) for impressing half-waves or half-wave segments of the alternating current (i) into the actuator is connected to devices (4_{S1}, 4_{S2} and 4_{S3}) to generate signals SR of a switching grid that is synchronized with the alternating current (i),
b) the controlling means (4_{ST}) encompasses logic means which, on the basis of signals (SR) of the switching grid, form conductive area signals (S10, S30) and (S20, S40) of

the initial position of the semiconductor switch pairs (S1, S3) and (S2, S4) connected in series,

c) the controlling means (4_{ST}) comprises means for the leading shift of the conductive areas of the switch pair (S2, S4) with respect to the initial position (S20, S40) during the rectifier operation and it also comprises means for the trailing shift of the conductive areas of the switch pair (S1, S3) with respect to the initial position (S10, S30) during the inverter operation,

d) the controlling means (4_{ST}) is connected to the regulating means (4_R) for purposes of supplying a signal (G/W) in order to set the direction of the shift and a signal (φ) in order to set the magnitude of the shift.

8. The device according to one of Claims 1, 3 to 7, characterized in that at least essential parts of the power transfer means and of the control device are arranged in the area of a rotor shaft and a rotor head that form the moving part of a rotary-wing aircraft.

9. The device according to Claim 8, characterized in that one or more capacitive actuators are arranged in at least one rotor blade of the rotary-wing aircraft.

10. The device according to Claim 8 or 9, characterized in that at least one primary winding (3a) is arranged on the stationary part of a rotor shaft bearing for purposes of power transmission, said primary winding (3a) corresponding to a secondary winding arranged on the rotor shaft.

11. The device according to one of Claims 8 to 10, characterized in that an azimuth sensor whose output is connected to the control device is arranged in the area of the rotor shaft.

12. The device according to one of Claims 9 to 11, characterized in that at least one sensor to detect the position of an aerodynamically effective means actuated by the capacitive actuator is arranged in the area of the rotor blade, the output of said means being connected to the control device.

13. The device according to one of Claims 8 to 12, characterized in that the actuator control element (4) and appertaining electronic controls are arranged in the rotor head and are

connected to the contactless power transmission means via lines arranged in the rotor shaft.

14. A method to provide the power of at least one capacitive actuator in accordance with the device according to one of Claims 1, 3 to 7, whereby the actuators are arranged on a moving part system that is separated from a stationary system by an isolating point (3c), characterized by the following process steps:
- in the stationary system, the frequency generator (2) generates a higher-frequency alternating current (i_G) from the direct voltage (1), said higher-frequency alternating current (i_G) having an amplitude that is independent of the phase angle and of the amplitude of a reverse voltage (u_G),
- the alternating current (i_G) is transmitted to the primary winding (3a) of an inductive transformer (3) that bridges the isolating point,
- the higher-frequency alternating current (i) coming from the secondary winding (3b) in the moving part system – separated into positive and negative half-waves or segments of these half-waves – is always impressed into the actuator by means of an electronic control element (4) in such a direction that a length change (Δs) of the actuator occurs in the desired direction in each half-wave.

15. A method to provide the power of at least one capacitive actuator in accordance with the device according to one of Claims 2 to 7, characterized by the following process steps:
- a frequency generator (2) generates a higher-frequency alternating current (i_G) from a direct voltage, said higher-frequency alternating current (i_G) having an amplitude that is independent of the phase angle and of the amplitude of a reverse voltage (u_G),
- the higher-frequency alternating current (i) – separated into positive and negative half-waves or segments of these half-waves – is always impressed into the actuator by means of an electronic control element (4) in such a direction that a length change (Δs) of the actuator occurs in the desired direction in each half-wave.

16. The use of a contactless electric power transmission means and/or control device according to Claims 1 to 15 in a rotary-wing aircraft.